Summary of Office Action

Claims 1 - 29 are currently pending. In the Office action, the following rejections were made:

- claims 1 - 5 were rejected under 35 U.S.C. §103(a) as being obvious in light of U.S. Patent 4,395,123 to Minott ("the Minott patent") and U.S. Patent 4,213,706 to Hill et al;
- claims 6 - 11 were rejected under 35 U.S.C. §103(a) as being obvious in light of U.S. Patent 5,999,311 to Nanba et al. ("the Nanba et al. patent") and the Minott patent;
- claims 12 - 28 are rejected uner 35 U.S.C. §103(a) as being obvious in light of the Nanbe et al. patent, the Minott patent and U.S. Patent 4,531,197 to Lin ("the Lin patent");
- claim 29 was rejected under 35 U.S.C. § 103(a) as being obvious in light of the Nanba et al. patent, the Minott patent, the Lin patent and the Hill et al. patent.

Claims 1 - 5 and 30 - 32

Claims 1 - 5 were rejected under 35 U.S.C. §103(a) as being obvious in light of the Minott patent and the Hill et al. patent. Applicant submits that neither of these references separately or in combination teach (see claim 1):

an entrance slit structure having an entrance slit extending in a first direction for receiving a beam of light having a photon flux within a predetermined spectral pass band;

a beam splitter aligned at an angle to the first direction so that the received beam of light is split into two separate beams; and

a reflective subsystem having a plurality of reflective surfaces defining separate light paths of equal optical path length for the two separate beams, the reflective surfaces arranged such that when the two beams emerge from the beam shearing system they contain more than 50 percent of the photon flux and the chief rays of the two separate beams are substantially parallel to each other and substantially perpendicular to the chief ray of the incident beam.

In addition, the references do not teach (see claim 33):

a first prism possessing a first surface acting as a beam splitter;

a second prism positioned to create an air gap between the second prism and the first surface;

wherein the first and second prisms are positioned such that the incident beam of light is incident on the first surface at an angle that prevents total internal reflection;

wherein the incident beam of light is split by the beam splitter into two separate beams of light that emerge from the beam shearing system; and

wherein the two beams of light are substantially parallel when they emerge from the beam shearing system and contain more than 50% of the incident light.

Claims 6 - 11

Claims 6 - 11 were rejected under 35 U.S.C. §103(a) as being obvious in light the Nanba et al. patent and the Minott patent. Applicant respectfully submits that claims 6 - 11 are patentable, because neither patent teaches or suggests to one of ordinary skill in the art the combination of the specific elements required by the inventions of claims 6-11.

In addition, applicants were unable to ascertain a teaching in either patent of "an optical system configured to recombine the two separate beams of light emerging from the beam shearing system onto an exit pupil."

Claims 12 - 28

Claims 12 - 28 were rejected under 35 U.S.C. §103(a) as being obvious in light of the Nanba et al. patent, the Minott patent and the Lin patent. In addition to the comments already made above in relation to limitations of the Nanba et al. and Minott patents, applicants respectfully submit that claims 12 - 28 are allowable on the basis that the references do not teach or suggest to one of ordinary skill in the art the combination of specific teachings from these three specific references.

In addition, applicants respectfully submit that neither Lin nor any of the other references teach "fore-optics having an asymmetric pupil and configured to collect light and focus it into a beam." The Nanba et al. patent discloses a wide-angle zoom system, which can shift a pupil along the optical axis. The invention of claims 12 - 28 includes an "asymmetric" pupil or a pupil shifted in a direction perpendicular to the optical axis. Applicant submits the amendments to claims 12 - 28 clarify the

distinction between these two shifts.

Claim 29

Claim 29 was rejected under 35 U.S.C. § 103(a) as being obvious in light of the Nanba et al. patent, the Minott patent, the Lin patent and the Hill et al. patent. Applicants respectfully submit that claim 29 is allowable, because one of ordinary skill in the art would clearly not have had motivation to combine specific teachings from four separate references, each of which addresses a distinctly different problem. In addition, the insufficiencies pointed out above in relation to these references also support the conclusion that claim 29 should be allowed.

Conclusion

Applicant believes that the claims pending in the case are in condition for allowance, and an early notice of allowability is respectfully requested. Applicant also wishes to draw the examiner's attention to the enclosed document evidencing the limited recognition granted to David J. Bailey under 37 C.F.R. § 10.9(b) to prosecute patent applications on behalf of Christie Parker & Hale LLP. If the Examiner believes that a telephone conference with Applicant's attorney might expedite prosecution of the application, please do not hesitate to call at the telephone number indicated below.

Respectfully submitted,

CHRISTIE, PARKER & HALE, LLP

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DJB/djb

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

Claims 1-4, 6-22, and 24-28 have been amended as follows:

1. (Amended) A beam shearing system for shearing an incident beam of light having a chief ray, comprising:

an entrance slit structure having an entrance slit extending in a first direction for receiving a beam of light having a photon flux within a predetermined spectral pass band;

a beam splitter aligned at an angle to the first direction so that the received beam of light is split into two separate beams; and

a reflective subsystem having a plurality of reflective surfaces defining separate light paths of equal optical path length for the two separate beams, the reflective surfaces arranged such that when the two beams emerge from the beam shearing system they contain more than 50 percent of the [~~said~~] photon flux and the chief rays of the two separate beams are substantially parallel to each other and substantially perpendicular to the chief ray of the incident beam.

2. (Amended) The beam shearing system in claim 1 wherein[~~:~~ ~~said~~] the two beams emerging from the beam shearing system contain substantially all of the light entering the system through the entrance slit.

3. (Amended) The beam shearing system in claim 1 wherein[~~:~~ ~~said~~] the two light paths [~~being of substantially equal optical path length and causing~~]defined by the reflective subsystem cause the wave fronts of the two separate beams to remain substantially in phase relative to one another when the beams emerge from the beam shearing system.

4. (Amended) The beam shearing system in claim 1 wherein[~~:~~ ~~said~~] the plurality of reflective surfaces are further arranged so that the separate beams of light are of substantially equal intensity, when they emerge from the beam shearing system.

6. (Amended) A spectral resolving system comprising:

an entrance slit structure having an entrance slit extending in a first direction for receiving a beam of light having a photon flux within a predetermined spectral pass band;

a beam shearing system including:

a beam splitter aligned at an angle to the first direction so that the received beam of light is split into two separate beams;

a reflective subsystem having a plurality of reflective surfaces defining separate light paths of equal optical path length for the two separate beams, the reflective surfaces arranged such that when the two beams emerge from the beam shearing system they contain more than 50 percent of the [~~said~~] photon flux and the chief rays of the two separate beams are substantially parallel to each other; and

an optical system [~~focusing the said~~] configured to recombine the two separate beams of light emerging from the [~~said~~]beam shearing system onto an exit pupil.

7. (Amended) The spectral resolving system of claim 6 wherein[~~:~~ ~~said~~] the optical system is also [~~focuses the said~~] configured to recombine the separate beams of light emerging from the [~~said~~] beam shearing system to create an image substantially perpendicular to the exit pupil plane.

8. (Amended) The spectral resolving system of claim 7 wherein:

[~~said~~]the optical system has an optical axis;

[~~said~~]the exit pupil is located in one of the group consisting of a tangential plane and a [~~sagittal~~] sagittal plane relative to the [~~said~~] beam shearing system;

[~~said~~]the image is located in the other of the group consisting of a tangential plane and a [~~sagittal~~] sagittal plane relative to the [~~said~~]beam shearing system; and

the exit pupil and the image are located at substantially the same position along the optical axis.

9. (Amended) The spectral resolving system of claim 6 wherein[~~:~~

———] the optical system is telecentric in [~~the said exit pupil plane~~] object space, where the object of the optical system is the entrance slit.

10. (Amended) The spectral resolving system of claim 6 wherein[~~:~~ ———] the optical system is anamorphic.

11. (Amended) The spectral resolving system of claim 6 wherein[~~:~~ ———] the [~~said~~]optical system cancels aberrations when it recombines the two beams of light that emerge from the beam shearing system.

12. (Amended) A static interferometer comprising:

fore-optics [~~for collecting light and focusing it~~] having an asymmetric pupil and configured to collect light and focus it into a beam;

a spectral resolving system comprising:

an entrance slit structure having an entrance slit extending in a first direction for receiving a beam of light [~~having a photon flux within a predetermined spectral pass band~~];

a beam shearing system including:

a beam splitter aligned at an angle to the first direction [~~so that~~] configured to split the received beam of light [~~is split~~] into two separate beams;

a reflective subsystem having a plurality of reflective surfaces defining separate light paths of equal optical path length for the two separate beams, the reflective surfaces arranged such that when the two beams emerge [~~from the beam shearing system they contain more than 50 percent of the said photon flux and~~]the chief rays of the two separate beams are substantially parallel to each other; and

an optical system [~~focusing the said~~] configured to recombine the two separate beams of light emerging from the [~~said~~]beam shearing system onto an exit pupil[~~; and ——— a detector located at the exit pupil~~].

13. (Amended) The static interferometer in claim 12, [~~wherein:~~

———] further comprising a detector located at the exit pupil.

[the detector comprises a detector array, read out electronics and a data processing system.]

14. (Amended) The static interferometer in claim 13 wherein[:

———]the detector is configured to record pixels of incident radiation intensity.[array records the intensity of the radiation incident on its pixels;]

[———the read out electronics digitizes the intensity measurements made by the detector array and transfers them to the data processing system; and

———the data processing system manipulates the digitized measurements to obtain information about the spectrum of said incident radiation.]

15. (Amended) The static interferometer in claim 14 [wherein] further comprising:

a data processing system connected to the detector; and

wherein the data processing system performs Fast Fourier Transforms on the digitized measurements to obtain the spectral composition of the incident radiation.

16. (Amended) The static interferometer in claim 14 [wherein] further comprising:

a data processing system connected to the detector; and

wherein the data processing system convolves the [digitized] measurements with [digital] filters to detect the presence or absence in the spectrum of the incident radiation of frequencies of radiation characteristically emitted or absorbed by particular substances.

17. (Amended) The static interferometer in claim 12 wherein[:

———]the two beams of light are recombined to form a single sided interferogram [is created at said] at the exit pupil.

18. (Amended) The static interferometer in claim 17 wherein the reflective surfaces of the reflective subsystem are configured such that when the two beams emerge from the beam shearing system they contain more than 50 percent of the photon flux of the received beam of light.[:

~~the fore-optics focus the collected light in such a way that the chief ray of the said collected light describes paths through the said spectral resolving system, which recombine on the said exit pupil at the edge of the said detector array; and~~

~~said paths of the chief ray have substantially the same optical path length.~~]

19. (Amended) The static interferometer in claim [~~18~~] 12 wherein the chief ray of light collected by the [~~said~~]fore-optics [~~have a shifted pupil design~~] is substantially to one side of the optical axis of the beam formed by the fore-optics.

20. (Amended) The static interferometer in claim 12 wherein[~~said~~] the fore-optics are telecentric.

21. (Amended) The static interferometer of claim 12 wherein[~~said~~]the optical system also focuses the [~~said~~]separate beams of light emerging from the [~~said~~]beam shearing system to create an image.

22. (Amended) The static interferometer of claim 21 wherein:

[~~said~~]the optical system has an optical axis;

[~~said~~]the exit pupil is located in one of the group consisting of a tangential plane and a s [~~sagittal~~] sagittal plane relative to the [~~said~~]beam shearing system;

[~~said~~]the image is located in the other of the group consisting of a tangential plane and a [~~sagittal~~] sagittal plane relative to the [~~said~~]beam shearing system; and

the exit pupil and the image are located at substantially the same position along the optical axis.

24. (Amended) A static interferometer comprising:

fore-optics for collecting light and collimating into a beam, the fore-optics possessing an exit pupil;

a [~~spectral resolving~~] beam shearing system comprising:

an entrance slit structure having an entrance slit extending in a first direction for receiving a beam of light having a photon flux within a predetermined spectral pass band;

a beam shearing system comprising:

a beam splitter aligned at an angle to the first direction so that the received beam of light is split into two separate beams;

a reflective subsystem having a plurality of reflective surfaces defining separate light paths of equal optical path length for the two separate beams, the reflective surfaces arranged such that one of the separate beams undergoes one reflection and the other of the separate beams undergoes three reflections and that when the two beams emerge from the beam shearing system they contain more than 50 percent of the said photon flux; and

a detector located at said exit pupil where the two beams emerging from the beam shearing system converge.

25. (Amended) The static interferometer in claim 24 wherein [:

———]the detector comprises a detector array, read out electronics and a data processing system.

26. (Amended) The static interferometer in claim 25 wherein:

the detector array records the intensity of the radiation incident on its pixels;

the read out electronics digitizes the intensity measurements made by the detector array and transfers them to the data processing system; and

the data processing system manipulates the digitized measurements to obtain information about the spectrum of [~~said~~] the incident radiation.

27. (Amended) The static interferometer in claim 26 wherein[:

———]the data processing system performs Fast Fourier Transforms on the digitized measurements to obtain the spectral composition of the incident radiation[;].

28. (Amended) The static interferometer in claim 27 wherein[:

———]the data processing system convolves the digitized measurements with digital filters to detect the presence or absence in the spectrum of the incident radiation of frequencies of radiation characteristically emitted or absorbed by particular substances.